

REMARKS

The Examiner is thanked for the thorough examination of the present application, and the indication that claims 27 and 40 contain allowable subject matter. Upon entry of the amendments in this response, claims 18–41 remain pending. In this response, a response is made and reconsideration and allowance of the application and presently pending claims are respectfully requested.

Rejections under 35 U.S.C. 112

The Office Action rejected claim 19 as allegedly indefinite. Applicant has amended claim 19 to clarify the language that the Office Action indicated was unclear, and as amended claim 19 clearly complies with the requirements of 35 U.S.C. § 112.

Rejections under 35 U.S.C. 102

The Office Action rejected claims 18-20, 24-25, 28-33, 37-38 and 41 under 35 U.S.C. 102 (b) as allegedly anticipated by Lee (US 6,492,256). Applicant respectfully traverses the rejections for at least the reasons that follow.

A proper rejection of a claim under 35 U.S.C. §102 requires that a single prior art reference disclose each element of the claim. *See, e.g., W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983). Anticipation requires that each and every element of the claimed invention be disclosed in a single prior art reference. *See e.g., In re Paulsen*, 30 F.3d 1475, 31 USPQ 2d 1671 (Fed. Cir. 1994); *In re Spada*, 911 F.2d 705, 15 USPQ 2d 1655 (Fed. Cir. 1990).

Independent claim 18, as amended, recites:

18. An interconnect structure with dielectric barrier, comprising:
 - a semiconductor substrate;
 - a plurality of stacked structures formed the semiconductor substrate, wherein each stacked structure comprises a conductive line and a conductive plug;
 - a conformal dielectric barrier fully covering the sidewall surfaces of the stacked structures; and*
 - a blanket second dielectric layer formed over the conformal dielectric barrier to form an inter-metal layer for insulating the stacked structures.*

(Emphasis Added). Applicant respectfully submits that claim 18 patently defines over the cited art because the cited art fails to disclose at least the features emphasized above.

With regard to the features emphasized above, the Office Action did not even allege those to be disclosed in the cited Lee reference. In this regard, the Office Action alleged only that Lee “teaches … a conformal dielectric layer (88) on the surfaces of the stacked layer, and a second dielectric layer (also 88) on the first layer.” As can be readily verified, this rejection ignores expressly recited claim features, including the conformal dielectric barrier “fully covering the sidewall surfaces of the stacked structures” and the blanket second dielectric layer “formed over the conformal dielectric barrier to form an inter-metal layer for insulating the stacked structures.” In this regard, the rejection has improperly ignored certain expressly recited claim features (which features are not disclosed in the cited Lee reference). For at least this reason, the rejection of claim 18 should be withdrawn.

In addition, the Office Action has relied upon the same dielectric layer (88) f Lee as allegedly being both the claimed “conformal dielectric barrier” AND the “blanked second dielectric layer.” This application of Lee is misplaced, as the same element cannot properly constitute two separate and distinct claim elements. For at least this additional reason, the rejection of claim 18 is misplaced.

In addition, dependent claim 28 recites:

28. The interconnect structure as claimed in claim 18, *further comprising at least one air-gap in the second dielectric layer between the stacked structures.*

(Emphasis Added).

At page 4, the Office Action alleges that the Lee reference recites an air gap 100 between the stacked structures as the feature/limitation emphasized above in claim 28. However, the air gap 100 illustrated in the Lee reference is directly formed between conductive structures 86, but not in a dielectric layer. Further, the Office Action fails to address the second dielectric layer between the stacked structures where the air gap should be formed in emphasized above in claim 28.

For 35 U.S.C. 102 rejections, a single reference must contain all material claimed features, either explicitly or inherently.

Therefore, Applicant respectfully submits that the cited reference is legally deficient for the purpose of anticipating claims 18 and 28. Specially, Applicant respectfully asserts that Lee fails to teach or disclose at least the feature/limitation emphasized above in claims 18 and 28. Therefore, Applicant respectfully asserts that claims 18 and 28 is in condition for allowance and that claims 19-20 and 24-25 which add further limitations are also allowable by virtue of their dependency on allowable independent claim 18.

In addition, independent claim 29, as amended, recites:

29. An interconnect structure with dielectric barrier, comprising:
a semiconductor substrate;
a pair of stacked structures formed the semiconductor substrate, wherein
each stacked structure comprises a conductive line and a conductive plug; and
a conformal dielectric barrier fully covering sidewalls of each stacked structure.

(Emphasis Added). Applicant respectfully submits that claim 29 patently defines over the cited art because the cited art fails to disclose at least the features emphasized above.

At page 4, the Office Action alleges that the dielectric layer 88 in the Lee reference discloses the feature/limitation emphasized above in claim 29. Applicant disagrees. In this regard, the layer 88 illustrated in the Lee reference is a conformal layer partially covering the sidewall surfaces of the conductive structure 86. Significantly, the layer 88 does not fully cover the sidewall surface, as expressly claimed (e.g., “fully covering sidewalls of each stacked structure.”). For at least this reason, the rejection of claim 29 is misplaced and should be withdrawn. As claims 30-41 depend from claim 29, the rejections of these claims should be withdrawn as well.

Furthermore, claim 41 recites:

41. The interconnect structure as claimed in claim 30, *further comprising at least one air-gap in the second dielectric layer between the stacked structures.*

(Emphasis Added)

In page 5, the Office Action alleges that the Lee reference recites an air gap 100 between the stacked structures as the feature/limitation emphasized above in claim 41. However, the air gap 100 illustrated in the Lee reference is directly formed between conductive structures 86 but not in a dielectric layer, and the Office Action fails to address the second dielectric layer between the stacked structures where the air gap should be formed in emphasized above in claim 41.

For 35 U.S.C. 102 rejections, a single reference must contain all material claimed features, either explicitly or inherently. Therefore, Applicant respectfully asserts that the cited reference is legally deficient for the purpose of anticipating claims 29 or 41. Specially,

Applicant respectfully asserts that Lee fails to teach or disclose at least the feature/limitation emphasized above in claims 29 and 41 for at least the same reasons, the rejections of claim 30-40, which depend from claim 29, are also allowable by virtue of their dependency on allowable independent claim 29.

Rejections under 35 U.S.C. 103

The Office Action rejected claims 22-23 and 35-36 under 35 U.S.C. 103(a) as allegedly unpatentable over Lee (US 6,492,256) in view of Zhou (US 6,325,842). Claims 21, 26, 34 and 39 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Lee (US 6,492,256) in view of Tsai (US 6,943,391). Applicants respectfully traverse these rejections, for at least the reason that independent claims 18 and 29 patently define over Lee, for at least the reasons set forth above. As claims 22-23 and 35-36 depend from allowable claims 18 and 29, the rejections under 35 U.S.C. § 103 should be withdrawn.

As a separate and independent basis for the patentability of all claims, Applicant respectfully traverses the rejections as failing to identify a proper basis for combining the cited references. In combining the Zhou and Lee references, the Office Action stated only that the combination would have been obvious “as the purpose of using a low dielectric constant material is to lower capacitance loading and coupling problems.” (Office Action, page 6). Similarly, in combining the Tsai and Lee references, the Office Action stated only that the combination would have been obvious because “silicon oxycarbide as taught by Tsai [is a] recognized equivalence to the etch stop layers used by Lee.” (Office Action, page 8) These alleged motivations are clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(Emphasis added.) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicant notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive an interconnect structure, as claimed by the Applicant.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, *inter alia*, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be “clear and particular.” Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 (“The absence of such a suggestion to combine is dispositive in an obviousness determination.”).

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000). The rationales relied on by the Office Action in the present application are merely generic statements, that have nothing to do specifically with the structures disclosed in the other references. As such, these rationales cannot be properly viewed as proper motivations for combining the specific teachings of the individual references. Indeed, the generic motivations advanced by the present Office Action could be used to support a combination of ANY references, which is clearly contra to the cited Federal Circuit precedent and the clear intent of 35 U.S.C. § 103.

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

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